

## Handbook for Developing a Public Water Supply Well





The Virginia Department of Health - Office of Drinking Water (ODW) has prepared this handbook to assist prospective or current public water supply owners with the development of new water supply wells. This handbook describes the procedures for selecting well sites, obtaining ODW approvals, and methods and materials required to construct a groundwater well source intended for potable water consumption. This document is not intended to be a comprehensive guide on drinking water wells, but it will provide a quick reference to state standards for developing of wells to serve public water supplies. It is the responsibility of the owner to insure that the well driller is licensed and complies with the requirements of the Virginia Waterworks Regulations. For more information regarding the rules and regulations pertaining to a public water supply, refer to the Virginia Waterworks Regulations, at 1

http://leg1.state.va.us/000/reg/TOC12005.htm#C0590.

**STOP!** This handbook is <u>not</u> applicable to the development of <u>private</u> wells. For more information on the site and construction criteria for private, non-public wells used for individual residences, small businesses, heat pumps, or irrigation, contact your local health department, or refer to the Commonwealth of Virginia State Board of Health *Private Well Regulations* at

http://leg1.state.va.us/000/reg/TOC12005.HTM#C0630

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<sup>1</sup> If you have difficulty accessing the Internet sites referenced in this document, please contact your local Field Office for assistance.

## Step 1: Identify Potential Well Sites

The siting, or placement, of a well is a crucial step in the development of a groundwater source. The location of a well may not only be dictated by general topography, but also by land use, property lines, and potential sources of contamination, such as waste disposal systems. The following sections describe issues that must be considered during the well siting process.

<u>Future property needs</u> When siting a well, it is very important to consider past and future land use in the proposed well area. Once a well is approved for public use, no construction or activity unrelated to the waterworks is allowed on the well lot.

As an owner, you have the right to request specific sites for your proposed well or wells. An ODW representative will perform an on-site inspection of the proposed well sites and may suggest more suitable locations, if necessary. If you have concerns or reservations about future land use or development plans, discuss these with your ODW Field Office.

<u>Potential sources of contamination</u> When selecting a well site, you should be knowledgeable of the location of nearby septic tanks, drain fields, sewage lines, or other actual or potential sources of contamination. If this

#### **Well Lot Dimensions**

Well lots are typically 100 ft. by 100 ft., centered on the well casing. However, larger dedicated well lots may be required if topography could direct potential contamination toward the well. Well lot dimensions will be discussed and established during the well site inspection.

information is unknown, contact the Local Health Department to obtain plans, diagrams and documentation regarding waste disposal in the vicinity of the proposed well. Coordinate with ODW and the Local Health Department to avoid possible conflicts regarding the placement of a future well, septic tank, or drain field.

<u>Well location standards</u> The following table lists the minimum horizontal distances from a proposed well to specific features required by the *Waterworks Regulations:* 

Feature	Minimum Separation Distance
Property lines	50 ft.
Power line / utility easements / rights of way	50 ft.
Sewage Line (Gravity Pipe or Force Main)	50 ft.
Septic Tanks	50 ft.
Drain Fields	50 ft.
Mass Drain Fields	50 ft.
Underground chemical / fuel storage vessel	50 ft., 100 ft. for plastic casing
Cemeteries	50 ft.
All known sources of contamination not shown above	50 ft.

New wells should also be located a minimum of 50 ft from existing wells and paved roads. Wells should not be located in parking areas.

<u>Wellhead protection</u> The purity and quality of groundwater can be seriously impacted by various human activities. For instance, failing septic systems, herbicide or pesticide usage, urban runoff, and the placement of nearby landfills, fuel storage, or industry may all degrade groundwater quality. Wellhead protection is a process for assessing potential threats, managing nearby land uses, and planning to prevent groundwater contamination. You can obtain more information about developing a wellhead protection plan for your public water supply from the Virginia Department of Environmental Quality (DEQ) at

www.deq.virginia.gov/gwpsc/whp.html

## Step 2: Schedule ODW Well Site Visit

The second step is to contact the Office of Drinking Water (ODW) to schedule a well site inspection. During this conference you should be prepared to submit a completed Waterworks Application (signed by the owner or agent) and discuss the scope of the proposed project. You should also be prepared to provide ODW with information about the proposed well sites you have selected prior to going out into the field for a well site inspection.

If the proposed project requires a new septic tank and drain field, the Local Health Department should be contacted prior to the well site inspection to avoid conflicts between the placement of the well and waste systems. The ODW personnel will assist in making the determination whether additional state agency involvement is required.

Contacting the Office of Drinking Water (ODW)  ODW operates six regional field offices throughout Virginia. More information about ODW can be found at <a href="https://www.vdh.virginia.gov/DrinkingWater/">www.vdh.virginia.gov/DrinkingWater/</a>			
Abingdon Field Office		East Central Field Office	
454 East Main Street Abingdon, VA 24210	Phone (276) 676-5650 Fax (276) 676-5659	300 Turner Road Richmond, VA 23225	Phone (804) 674-2880 Fax (804) 674-2815
Lexington Field Office		Danville Field Office	•
131 Walker Street Lexington, VA 24450	Phone (540) 463-7136 Fax (540) 463-3892	1347 Piney Forest Road Danville, VA 24540	Phone (434) 836-8416 Fax (434) 836-8424
Southeast Virginia Field Off	fice	Culpeper Field Office	•
830 Southampton Avenue Norfolk, VA 23510	Phone (757) 683-2000 Fax (757) 683-2007	400 South Main Street Culpeper, VA 22701	Phone (540) 829-7340 Fax (540) 829-7337

## Step 3: Obtain Approvals



A representative from your ODW Field Office will perform an on-site assessment of each proposed well location. The assessment will include an evaluation of the well's susceptibility to contamination. [The location requirements are given in the *Waterworks Regulations*, section 12VAC5-590-840A.] Sketches, maps, measurements, and coordinates will be noted during the well site inspection. If acceptable, tentative approval will be given in a written letter that shall include topographic maps with the proposed site(s) identified, well lot sketches identifying any potential sources of contamination, and significant landmarks.

The ODW approval of the well site(s) is valid for 12 months. If drilling of the well has not begun within 12 months of the approval date, then the proposed sites will need to be reinspected by ODW personnel.

#### **Wells located in Groundwater Management Areas**

At this time in Virginia, the Department of Environmental Quality (DEQ) administers a Ground Water Withdrawal Permit Program to manage water resources within two specific geographical regions of Virginia<sup>2</sup>. DEQ must be contacted if a well is to be developed in Virginia's Ground Water Management Areas to determine if a Groundwater Withdrawal Permit is required.

If a Groundwater Withdrawal Permit is required by DEQ, it is crucial to coordinate the permitting requirements of both State agencies. DEQ may require specific construction features if a well is drilled through multiple aquifers (typical of the Coastal Plain region). Also, DEQ's Aquifer Test Plan differs from the well yield and drawdown testing typically required by ODW. ODW strongly recommends that you consult DEQ and determine what construction and testing requirements will apply before drilling and developing a public water supply well.

Further information regarding DEQ's permit program and groundwater management in Virginia can be found at

#### www.deg.virginia.gov/gwpermitting/

Groundwater Management Areas administered by DEQ as of April 30, 2008 <sup>2</sup> :		
Eastern Shore GWMA Counties of Accomack and Northampton		
Eastern Virginia GWMA	Counties of Charles City, Chesterfield*, Hanover*, Henrico*, Isle of Wight, James City, King William, New Kent, Prince George, Southampton, Surry, Sussex, York, and the Independent Cities of Chesapeake, Franklin, Hampton, Hopewell, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, and Williamsburg	

<sup>\*</sup> Only those portions east of Interstate 95 are included in the Eastern Virginia GWMA

#### Wells located east of Interstate 95 & outside Groundwater Management Areas

It is likely that Virginia's ground water management areas will be expanded in the future to include the entire Coastal Plain - essentially all land east of Interstate 95. When that occurs, water withdrawal permit applications in the Coastal Plain will require submission of an electronic bore hole geophysical log for each well. The DEQ Office of Ground Water Characterization (OGWC) strongly suggests that bore hole geophysical logs be obtained in newly constructed public water supply wells in the Coastal Plain at the time of drilling, since it is impossible to obtain a geophysical log of the well once it is completed. By obtaining a bore hole geophysical log at the time of drilling, you will already have one of the most important pieces of information necessary to obtain a withdrawal permit. You will also avoid the future expense of drilling a separate boring solely to obtain a geophysical log for an existing well. The geophysical logs can be used to select accurate well screen placement depths, and can assist in analyzing well yield and water quality issues.

Additional information about geophysical logging and discussion of the benefits of bore hole geophysical logs can be obtained at the DEQ OGWC website:

http://www.deq.virginia.gov/gwcharacterization/

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<sup>&</sup>lt;sup>2</sup> You should also verify the most current Ground Water Management Area designations with DEQ.

## Step 4: Drill, Case, and Grout Well

The proper drilling, casing, and subsequent grouting of a proposed well is essential to maintain water quality and reduce potential susceptibility to contamination. A variety of issues may contribute to the manner in which the well source is developed, including siting requirements, geological conditions, and borehole and casing depths. This step details information that may affect the methods, procedures, supplies, and materials used to develop a groundwater source.

<u>Licensed well driller</u> Only licensed well drillers are allowed to develop, remediate, or abandon public well sources. To determine if a particular well driller is licensed with the Virginia Board for Contractors, contact the Virginia Department of Professional and Occupation Regulation at 9960 Mayland Drive, Suite 400, Richmond, VA 23233 (804) 367-8511, or

www.dpor.virginia.gov/dporweb/dpormainwelcome.cfm

#### **Planning for Sampling**

After the well is drilled, a yield and drawdown test of the well is performed, and bacteriological, chemical, and radiological samples are collected. Prior to drilling, it is essential that you discuss with your licensed well driller the sampling requirements in order to have the necessary sample containers on hand. These procedures are described in Step 5.

<u>Materials, casing, and grouting</u> All well construction materials and components must meet appropriate specifications and standards stated in the Virginia *Waterworks Regulations*, (see section 12 VAC 5-590-840.B.). This includes well casing material (steel or plastic) and grout.

**IMPORTANT:** Requirements for materials acceptable for use in the installation of PUBLIC WATER SUPPLY WELLS are more restrictive than requirements for PRIVATE WELL construction. If you or your well driller have any questions regarding the proper materials to use, contact your ODW field office.



Six-inch steel well casing. Photo courtesy Dempsey Steel Pipe, Inc.

<u>Well construction classification</u> Your well site approval letter will specify the minimum construction class for your proposed wells. The well construction classifications are described below:

Class I	<ul> <li>Drilled and cased to a depth sufficient to exclude undesirable groundwater, NO LESS THAN 100 feet in depth</li> <li>Drill hole diameter at least 3 inches greater than the outside diameter of the couplings of the casing</li> <li>Annular space around the casing grouted to a depth of at least 100 feet</li> </ul>
Class II B	<ul> <li>Drilled and cased to a depth sufficient to exclude undesirable groundwater, NO LESS THAN 50 feet in depth</li> <li>Drill hole diameter at least 3 inches greater than the outside diameter of the couplings of the casing</li> <li>Drill hole terminates in solid rock or other impervious formation (when practical)</li> <li>Annular space around the casing grouted to a depth of at least 50 feet</li> </ul>
Class II A (constructed infrequently)	<ul> <li>Drilled and cased to a depth sufficient to exclude undesirable groundwater, NO LESS THAN 100 feet in depth</li> <li>Drill hole passes through at least 50 ft of unconsolidated formation that will collapse against the casing</li> <li>Annular space around the casing grouted to a depth of at least 20 feet</li> </ul>

<u>Wells in rock</u> Class II B wells constructed in hard rock must have well casing extended to a depth of 50 feet, terminating in a minimum of 5 feet of rock. If rock is encountered at a depth of less than 50 feet, the casing must still extend to a depth of at least 50 feet. The well must be pressure grouted from the bottom of the annular opening to ground level.

<u>Drilling documentation</u> The licensed well driller must complete a drilling log and submit this to ODW, using the Water Well Completion Report, Form GW-2. This form can obtained at

www.deg.state.va.us/export/sites/default/gwpermitting/documents/GW-2 TEMPLATE073107.pdf

**Grouting** The well driller must notify the appropriate ODW Field Office of the date and time that the well will be grouted. This information should be provided as soon as possible so that an ODW representative may be present during grouting.

<u>Proper well abandonment</u> Any well, whether intended for production, observation, or study purpose, that is not completed in accordance with the construction requirements of the *Waterworks Regulations* must be permanently abandoned in a manner that restores the pre-existing geological conditions, unless the Virginia Department of Environmental Quality (DEQ) agrees to assume responsibility for the well for research or testing purposes. For further information on transferring the well to DEQ, refer to DEQ's Office of Groundwater Characterization, at

www.deq.state.va.us/gwcharacterization/homepage.html .

Wells that have been drilled should be promptly abandoned once the decision is made to not place the well into service, since wells that are not properly abandoned may increase the risk of contamination of the aquifer from the surface, or other groundwater zones. Information on proper abandonment procedures is given in the *Waterworks Regulations* 12 VAC 5-590-840.B.14.

### Step 5: Develop Well

Well development consists of conditioning (if warranted), disinfection, yield and drawdown testing, and sampling after the well is drilled. The well *should* be disinfected prior to sampling due to the activities and exposures associated with the drilling process. The well *must* be disinfected after the production pump (if different from the test pump) is installed. Generally, a licensed well driller is aware of the proper methods required to disinfect a well. The correct disinfection procedures for disinfection a well with chlorine are given in ANSI / AWWA Standard C654 - Disinfection of Wells.

The well yield and drawdown data are required to determine the capacity of the source, assist in selecting a pump, and verifying that the source will be sufficient for the public water system's needs. The samples are analyzed for bacteriological and chemical qualities, and are evaluated to determine if water treatment will be required.

<u>Yield & drawdown tests</u> The well and pump capacity of a groundwater source must be determined before the well will be approved for public use. The data gathered from the yield test is crucial to the waterworks, since a low yield may mean additional sources or storage will be needed to meet the waterworks' needs, or limit the waterworks' service capacity.

If a new well is located within 500 feet of an existing one, and both wells will be used, a simultaneous pump test should be conducted. At a minimum, adjacent wells must be monitored during the test if they cannot be tested simultaneously. This will assure better information with which to determine the safe yield of both sources.

Generally, the yield and drawdown test duration is at least 48 hours.<sup>3</sup> ODW recommends that the pumping rate be controlled throughout the test to maximize the production from the well, and to produce a stabilized pump water level for at least the last six hours of the yield test. Immediately following the yield and drawdown test the water level recovery in the well should be recorded for no less than 6 hours or until the well returns to its static water level, whichever occurs first. A standard report form is available at

www.vdh.virginia.gov/DrinkingWater/Owners/WellDevelopmentProcedures.htm/
Well Yield and Recovery Report Form(Excel).xls

As noted previously, the testing required for DEQ's Groundwater Withdrawal Permit may differ from tests generally prescribed by ODW for public supply wells. A test procedure that meets the needs of both the DEQ and ODW may be developed with coordination of both agencies.

<u>Laboratory selection</u> Either the Division of Consolidated Laboratories (DCLS), or a laboratory certified by DCLS must perform all bacteriological, radiological and chemical testing of the water samples from a proposed well. A list of certified labs is available at the DCSL web site:

www.dgs.virginia.gov/DivisionofConsolidatedLaboratoryServices/tabid/453/Default.aspx

If you would like to use DCLS for your well development testing, you can also refer to the DCLS web site for sample kit order forms and sample collection and shipping instructions.

<u>Bacteriological sampling</u> The bacteriological quality of every proposed groundwater source for a public water supply must be evaluated. The purpose of these tests is to determine if continuous disinfection or additional treatment is required for the waterworks. For a newly constructed well, or a well undergoing modification or reconditioning, a series of 20 bacteriological samples must be collected during the latter portion of the yield and drawdown test. The 20 samples must be analyzed by a Most Probable Number (MPN) method for total coliform bacteria and *E. coli*. The MPN samples should ideally be collected at one hour intervals. If a different time interval is desired, contact your regional ODW Field



#### **Sampling Challenges**

Some of the developmental samples that must be taken at your new well may have special collection or shipping requirements. For example, bacteriological MPN samples must be received by your laboratory for processing within 30 hours of collection. Consult with your laboratory on sampling preservation, holding times, and other special requirements.

Office for prior approval. Ensure hygienic methods are used during the collection of these samples in order to avoid accidentally contaminating a sample.

If DCLS is used for MPN testing, you should notify DCLS at least 24 hours prior to sampling, to ensure that the samples will be

accepted and processed. It is recommended that similar arrangements be made with any private laboratory that you use.

<u>Chemical, physical and radiological sampling</u> In addition to monitoring the microbial character of the well source, a variety of chemical, radiological and physical parameters must be checked during well development in order to ensure adequate water quality. The specific parameters required for testing and the number of samples required will be determined by ODW. Tests include analysis of metals, inorganic chemicals (including nitrate, nitrite, and cyanide), physical parameters, radiological contaminants, (such as uranium and radium), and volatile organic chemicals (such as fuels and solvents), and synthetic organic chemicals (including pesticides and herbicides). During the well site inspection, a susceptibility assessment will be performed by ODW for the water source to determine what, if any, synthetic organic chemical tests can be omitted from required well development testing.

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<sup>&</sup>lt;sup>3</sup> Part IV of the *Waterworks Regulations* permits a reduction in the well drawdown test duration for Noncommunity waterworks having a production of less than 3 gpm. This reduction must be approved by ODW prior to conducting the test.

The chemical and radiological samples should be collected near the end of the yield and drawdown test, prior to the recovery period.

For detailed information regarding water quality standards, potential health effects, and typical sources of contamination, refer to EPA's National Primary Drinking Water Standards at

www.epa.gov/safewater/consumer/pdf/mcl.pdf

<u>Well development test results</u> ODW will review the well test data upon receipt. The yield and drawdown test results, along with results from the bacteriological and chemical sampling, will be used to determine how much water the well can reliably produce, and whether the water will need to be treated to meet water quality standards. Most laboratories (including DCLS) will report bacteriological and chemical test results directly to ODW. You will be advised of the results, their interpretation, and any additional or follow-up testing needed.

Test results will be discussed with you and your design engineer during a Preliminary Engineering Conference (PEC). The PEC is a feasibility discussion that establishes the direction and scope for new waterworks construction. The PEC dialog is also invaluable for owners who are developing a new well to serve an existing waterworks. The conference provides for an exchange of information between all parties, during which the envisioned construction project will be discussed in its entirety. The discussion can reveal potential problems with anticipated waterworks design or operation.

#### **Design Considerations**

The Virginia *Waterworks Regulations* provides detailed standards for the design and construction of public water supply wells. Required appurtenances include a sanitary seal for the top of the well casing, a properly screened vent, sampling tap, well pump controls, a concrete floor or apron surrounding the well, and well pump support. A means for measuring water level in the well is also required. All such appurtenances must be detailed in the construction plans and specifications that you and your design engineer must submit to ODW. However, such features should not be installed until the plans have been approved, and a construction permit issued.

To protect the well after it has been drilled, cased, and grouted (but before the construction permit has been issued), ODW recommends securely capping the well casing.

## Step 6: Obtain ODW Permits

The approval you will have obtained from ODW by following Steps 1 through 5 is limited to well drilling, casing, grouting, and testing. Steps 1 through 5 of the well development process are designed to answer basic questions about your proposed water supply source:

- Do the well lot and location meet basic requirements for size, clearances to boundaries, and protection from potential sources of contamination?
- Once the well has been drilled and installed, does it produce enough water to meet the waterworks' needs?
- Now that the well has been tested, is the water quality suitable, or is treatment needed to remove contaminants?

Further construction of the water well, including installation of the permanent pump, electrical service, appurtenances, housing, storage vessels, or distribution system plumbing is not authorized until ODW issues a <u>construction permit</u>. Obtaining needed permits is your next step.

If you are developing a new well for an existing public water supply (for which you already have a valid Waterworks Operation Permit), the procedures for obtaining a construction permit can be found at <a href="https://www.vdh.virginia.gov/drinkingwater/documents/permitapplications/construction">www.vdh.virginia.gov/drinkingwater/documents/permitapplications/construction</a> permit guidelines.pdf .

Otherwise, you should follow the steps for obtaining an Operation Permit (which will encompass issuance of any necessary construction permits), at

www.vdh.virginia.gov/drinkingwater/documents/permitapplications/operation\_permit\_guidelines.pdf

Contact your ODW Field Office for assistance and guidance during the permitting process. The ownership and operation of a public water system is an important responsibility. The permitting process is designed to ensure owners are aware of the technical, financial, and managerial responsibilities associated with operation of a public water system.

Well lot plat and dedication One component of the well siting process is the completion of a well lot plat and dedication document. The intent of these materials is to describe the proposed well lot and record the information to ensure the well lot is only used for waterworks related materials or activities. Therefore, no additional buildings, parking lots, or storage may occur on or within the well lot. The plat must be signed by the clerk of the respective court, noting the deed book, page number and date. The well lot dedication document must also be signed by the clerk of the court and notarized. Appendix I includes a sample Well Dedication form, to be used for most public and privately-owned waterworks. Federal and State-owned waterworks may use a slightly different form, the Well Lot Certification; a sample of which is also provided in Appendix 2. You will be required to submit these documents when you submit plans and specifications to obtain a waterworks construction permit.

Notes	

# Appendix 1 Well Dedication and Certification Documents

#### **DEDICATION DOCUMENT**

Use this model DEDICATION DOCUMENT for wells that are owned by individuals, home owners' associations, corporations, or municipalities. This model is not recommended for state or federal entities.

, a \	/irginia Corporation, does dedicate that tract or parcel of real
estate situated, lying and being in	County, Virginia, more particularly described by Pages,, and
deed and plat of survey of record in Deed Bo	ok, Pages,, and
of the Clerk's Office of the Circuit Court of	County, Virginia, and being the
identical real estate which said corporation a English covenants from water supply use only, and the said	acquired by grant with General Warranty of Title and Modern Said dedication being to establish the aforesaid area for agrees that only appurtenances be constructed in said area dedicated and that said lot
(number) will not be used for human hal	bitation or other sources of contamination.
this instrument is solely for the purpose of a Virginia as to the matters hereinabove set fo	area dedicated shall remain with the and assuring the Department of Health of the Commonwealth of orth so long as said parcel is used for a water supply system; d of no further effect should the well on the said premises be upply system cease.
WITNESS the following signatures and seal t	this_day of
	Ву:
	Attest:
do hereby certify that	Notary Public for the County aforesaid in the State of Virginia, whose names are signed to the writing above,day of,
, nave acknowledged the same belof	te the in my County aloresald.
Given under my hand thisday	of
Note	om / Dublio
NOTE	ary Public
My commission expires	

#### **WELL LOT CERTIFICATION**

Use this model WELL LOT CERTIFICATION for wells that are owned by state and federal entities

WHEREAS, The Commonwealth of Virgin	nia, through
being inCity (County), \_\_Deposit) recorded in Deed Book	, is the owner in fee simple of certain real property lying and Virginia, more particularly described by <u>(Deed or Certificate or at pagein the Office of the Circuit Court of</u>
, Virginia and	
	(Legal Owner) e aforesaid real property a well and appurtenances thereto for the or to more than 25 individuals, said well lying within the well lot eto and made part hereof,
Department of Health, issued pursuant amended, the ( <u>Legal Owner</u> ) hereby cert hereafter be used for water supply purpos located thereon shall be those which a	ith the <i>Waterworks Regulations</i> , § 5-590-840 of the Virginia to Chapter 6, Title 32.1 of the <i>Code of Virginia</i> (1979), as tifies to the Department of Health that the aforesaid well lot shall sees only, and that the only improvements or appurtenances to be tree necessary or convenient to the operation of a waterworks.  (Legal Owner) shall not be used for any purpose which would cause contamination of the
well lot shall be properly used for a water that any subsequent owner of the wel regulations and restrictions, so long as so public or more than twenty-five individuals	Certification is to assure the Department of Health that the said r supply system only. The Certificate also provides public notice II lot and water supply system shall be subject to the same uch parcel of land is used for a water supply system serving the s. This certification shall be null and void and of no further effect es be abandoned and the use thereof for a water supply system
WITNESS the following signature of the _ this day of	<u>(Legal Owner)</u>
do certify that .	ry Public for the City/County of aforesaid in the State of Virginia, whose name is signed to the foregoing writing, bearing date on ged the same before me in my City/County aforesaid.
Given under my hand this	day of
	Notary Public
My commission expires	